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Studies on biochemical composition and anti-oxidant enzyme of chickpea (*Cicer arietinum* L.) cultivars

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Abstract
The present study was conducted to evaluate ten advance varieties of chickpea for biochemical composition and anti-oxidant enzyme of chickpea was carried out at Student's Instructional Farm and in the laboratory of Department of Biochemistry. A significante variation was detected for all traits suggested that there was considerable variability among variety. Carbohydrate content ranged 53.66-66.00 per cent in various chickpea Desi and Kabuli varietie. Maximum carbohydrate content was found 66.00 per cent in variety NDG 98-3 followed by 64.00 per cent in variety NDG 12-1. Reducing sugar content ranged 1.33-1.70 per cent. Maximum reducing sugar content was observed 1.70 per cent in NDG 98-3 followed by 1.65 per cent in variety NDG 12-1 and 1.64 per cent in NDGK 99-9 and Non- reducing sugar content ranged 2.73-3.27 per cent. Maximum non- reducing sugar content was found 3.27 per cent in NDG 98-3 followed by 3.3.23 per cent in NDG 12-1 and 3.20 per cent in KWR 108 variety. Total sugar content ranged 4.08-4.97 per cent in all the varieties of chickpea analyzed in this investigation. Maximum total sugar was found 4.97 per cent in NDG 98-3 followed by 4.88 per cent in variety NDG 12-1. The values ranged 638-908.33 in mg fresh wt. per min. highest catalase activity was found in BG 1003 (908 in mg fresh wt. per min.) followed by PUSA 267 (857 in mg fresh wt. per min.), while lowest found in PANT G 186 and UDAI variety and It ranged 59.78 -83.41 in mg fresh wt. per min. It was observed at highest peroxidase activity in BG 1003 (83.41in mg fresh wt. per min.) followed by NDGK 99-9 (82.37 in mg fresh wt. per min.), NDGK 98-8 (82.36 in mg fresh wt. per min.) and utilize in further research work.

Keywords: Carbohydrate, reducing sugar, non reducing sugar, total sugar and catalyze, peroxidase

Introduction
Chickpea (*Cicer arietinum* L.) belongs to the family Leguminaceae is an important winter season pulse crop having extensive geographical distribution. Chickpea is also known as Gram, Bengal gram, Garbanzo bean and sometimes known as Egyptian pea, *ceci*, *cece*or *chana*. Chickpea nitrogen fixation plays an important role in maintenance of the soil fertility, particularly in the arid and low rainfall areas (Varshney *et al.*, 2009) [18].

Chickpea is an important pulse crop grown and consumed all over the world, especially in the Afro-Asian countries. Currently, chickpea is grown in over 50 countries across the Indian subcontinent, North Africa, the Middle East, Southern Europe, the America and Australia (Roy *et al.*, 2010) [15]. The major chickpea producing states are Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Uttar Pradesh and Karnataka. In India, chickpea is cultivated in an area of 9.93 million/ha. With production of 9.53 million tonnes and yield is 960 kg/ha (D.E.S., Ministry of Agriculture, G.o.I., 2014-15). The state wise chickpea production Madhya Pradesh area of 3160 (Thousand/ha) with production of 3299.1 (Thousand/tonnes) and yield is 1044 (kg/ha). A pulse, including chickpea is one of the most important crops of the world due to their nutritional quality. They are rich sources of carbohydrates, protein, vitamins and minerals (Costa *et al.*, 2006 and Gowen *et al.*, 2007) [7, 9].Chickpea contains nutritionally important minerals, notably calcium and iron, and the availability of iron is reported to be good (Murty *et al.* 2010). Total carbohydrate, reducing sugar, non reducing sugar, total sugar, crude fiber content in chickpea. Total carbohydrate ranged from 68.81-72.44%, reducing sugar from23.89-25.81%, non-reducing sugar from 38.34-42.32%, total sugar from 63.45-66.98%

Crude fiber from 6.45-7.85 % (Atul *et al*., 2011) [3] Chickpea is a good source of carbohydrates and proteins, which together constitute about 80% of the total dry seed mass. The starch content of chickpea cultivars have been reported to vary from 41% to 50%. The kabuli type contains more soluble sugars (Jambunathan *et al*. 1980) [10]

Starch is the major storage carbohydrate followed by dietary fibre, oligosaccharides and simple sugars such as glucose and sucrose. Although lipids are present in low amounts, chickpea is rich in nutritionally important unsaturated fatty acids such as linoleic and oleic acids. β-Sitosterol, campesterol and stigmasterol are important sterols present in chickpea oil. Ca, Mg, P and, especially, K are also present in chickpea seeds. Chickpea is a good source of important vitamins such as riboflavin, niacin, thiamine, folate and the vitamin A precursor β-carotene. As with other pulses, chickpea seeds also contain anti-nutritional factors which can be reduced or eliminated by different cooking techniques. Chickpea has several potential health benefits, and, in combination with other pulses and cereals, it could have beneficial effects on some of the important human diseases such as CVD, Type 2 diabetes, digestive diseases and some cancers (Jukanti AK *et al.* 2012.) [11]. Chickpea seed has a high protein digestibility, contains high levels of complex carbohydrates (Low glycaemic index), is rich in vitamins and minerals and is relatively free from anti-nutritional factors (Muzquiz and Wood, 2007; Wood and Grusak, 2007) [13].

Chickpea is mostly consumed in the form of processed whole seed or Dal. It is used in preparing varieties of snacks, sweet and condiments. Fresh green seed are also consumed as green vegetables and its leaves consist of malic acid and citric acid which are very useful for stomach problem and it is best blood purifier. It is used for human consumption as well as for feeding to animals. Nitrogen fixation plays an important role in maintenance of the soil fertility, particularly in the arid and low rainfall areas as chickpea being cropped under crop rotation (Roy *et al*., 2010) [15].

Phytates, oxalates, polyphones from insoluble complexes with essential dietary components like vitamins, minerals rendering them unavailable to body. Removal of these anti-nutritional factors *via* genetic amendment may be catastrophic since these compounds have alternative beneficial roles in plants. Hence, removal of anti-nutritional factors prior to consumption is a better way of handling the problem.

Pulses have shown numerous health benefits, e.g. lower glycemic index for people with Diabetes and Valentine-Gamazo, increased satiation and Cancer prevention as well as protection against cardiovascular diseases due to their dietary fibre content (Chillo *et al*., 2008) [6].

Material and Methods

The present research work was carried out during winter season pulses crop ten variety of chickpea namely UDAI, PANT G 186, NDG 5-21, ND 12-1, NDG 98-3, KWR 108, NDGK 98-8 BG 1003, NDGK 99-9 and PUSHA 267 was growing at Students Instructional Farm of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad (U.P.) in CRD design with three replication and after harvesting the seed were collected in gunny bags and stored in decicator for further biochemical analysis. Total carbohydrate content was determined as described by Yemme and Wills (1954) [20]. Reducing sugar content in chickpea seed was determined by the method of Miller (1959) and the non-reducing sugar content was obtained by subtraction of reducing sugar from total sugar.

Non-reducing sugar = (Total sugar – Reducing sugar) x 0.95

Total sugar was determined by the method of Dubois *et al*., (1950) [8]. And the catalasae activity was determinend by the method of Sinha (1972) [17] and the activity of peroxidase enzyme was determined by the method given by Mc. Curne and Galston (1959) in present research work.

Result and Discussion

Carbohydrate content ranged 53.66-66.00 per cent in various chickpea Desi and Kabuli varieties. Maximum carbohydrate content was found 66.00 per cent in variety NDG 98-3 followed by 64.00 per cent in variety NDG 12-1. Minimum carbohydrate content was found 53.66 per cent in variety PANT G 186. Out of ten genotypes, genotype NDG 98-3 was found superior which gave total carbohydrate 66.00 per cent. The result was closely supported by Benu and Srivastav (2006) [4]. Reducing sugar content ranged 1.33-1.70 per cent. Maximum reducing sugar content was observed 1.70 per cent in NDG 98-3 followed by 1.65 per cent in variety NDG 12-1 and 1.64 per cent in NDGK 99-9. Minimum reducing sugar content was observed in 1.35 per cent variety PANT G 186. Statistically these are significant differences among the varieties of chickpea related reducing sugar content and Non-reducing sugar content ranged 2.73-3.27 per cent. Maximum non- reducing sugar content was found 3.27 per cent in NDG 98-3 followed by 3.3.23 per cent in NDG 12-1 and 3.20 per cent in KWR 108 variety. Minimum non- reducing sugar content was found 2.73 per cent in PANT G 186 variety. Variations in the non- reducing sugar content were also found statistically significant. These results have been favoured by Atul *et al*., (2011) [3], Shad *et al.*, (2009).

Total sugar content ranged 4.08-4.97 per cent in all the varieties of chickpea analyzed in this investigation. Maximum total sugar was found 4.97 per cent in NDG 98-3 followed by 4.88 per cent in variety NDG 12-1. Minimum total sugar content was found 4.08 in PANT G 186. Varieties differed significantly among themselves regarding sugar content. Maximum total sugar content was observed 4.97 per cent in NDG 98-3 which was statistically significant higher over the rest varieties. These results are in agreement to Atul *et al*., (2011) [3], Shad *et al.*, (2009) [16].

The values ranged 638-908.33 in mg fresh wt. per min. highest catalase activity was found in BG 1003 (908 in mg fresh wt. per min.) followed by PUSA 267 (857 in mg fresh wt. per min.), NDG 5-21 (855 in mg fresh wt. per min.) and minimum was noticed in UDAI (638 in mg fresh wt. per min.). Out of ten genotypes, genotype BG 1003 was found superior which gave catalase enzyme activity 908.33 (mg fresh wt. per min.). Among these genotypes variation in catalase enzyme activity due to genetical character. The result closely supported with Mandal and Singh (2000) [12] and Natu *et al*., (2003) [14].

In respect of peroxidase activity in chickpea leaves witnessed significant variation. It ranged 59.78 -83.41 in mg fresh wt. per min. It was observed at highest peroxidase activity in BG 1003 (83.41in mg fresh wt. per min.) followed by NDGK 99-9 (82.37 in mg fresh wt. per min.), NDGK 98-8 (82.36 in mg fresh wt. per min.) and minimum peroxidase activity was noticed in NDG 98-3 (59.78 in mg fresh wt. per min.). The result closely supported with Acharya *et al*., (1990) [1], Chen and Kao (1995) [5] and Natu *et al*., (2003) [14].

Table 1: Carbohydrate, reducing sugar, non-reducing sugar and total sugar in chickpea genotype

S.No	Name of Varieties	Carbohydrate content	Reducing	Non-reducing	Total sugar	Total sugar
1.	UDAI	54.00	1.45	2.74	4.19	4.19
2.	PANT G 186	53.66	1.35	2.73	4.08	4.08
3.	NDG-5-21	57.00	1.61	3.11	4.72	4.72
4.	NDG 12-1	64.00	1.65	3.23	4.88	4.88
5.	NDG 98-3	66.00	1.70	3.27	4.97	4.97
6.	KWR 108	62.66	1.62	3.20	4.82	4.82
7.	NDGK 98-8	60.66	1.63	3.00	4.63	4.63
8.	NDGK 99-9	60.00	1.64	3.17	4.81	4.81
9.	BG 1003	56.66	1.59	2.94	4.53	4.53
10.	PUSA 267	59.00	1.60	2.96	4.56	4.56
11.	SEm±	2.21	0.04	0.10	0.16	0.16
12	CD (at 5%)	6.54	0.01	0.31	0.49	0.49

Table 2: catalase and peroxides enzyme in chickpea genotype

S. No	Name of Varieties	Catalase activity	Peroxidase activity
1.	UDAI	638.33	61.96
2.	PANT G 186	738.33	60.01
3.	NDG-5-21	855.00	64.93
4.	NDG 12-1	747.00	61.25
5.	NDG 98-3	639.33	59.78
6.	KWR 108	843.33	72.38
7.	NDGK 98-8	708.33	82.36
8.	NDGK 99-9	823.33	82.37
9.	BG 1003	908.33	83.41
10.	PUSA 267	857.00	80.51
11.	SEm±	8.17	0.83
12	CD (at 5%)	24.12	2.45

Conclusion

In the light of foregone analysis and observation of the study related biochemical and anti-oxidant enzyme parameter based, the result generated five most important varieties chickpea genotype NDG 98-3 and BG 1003. Out of these BG 1003 constituted highest catalase, peroxidase whereas, chickpea NDG 98-3 constituted highest carbohydrate, reducing, non-reducing and total sugar. In view of promising varieties, BG 1003 and NDG 98-3 chickpea was found to be best fit for qualitative and health aspect.

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